



Commonwealth of Virginia

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

1111 E. Main Street, Suite 1400, Richmond, Virginia 23219

P.O. Box 1105, Richmond, Virginia 23218

(800) 592-5482

www.deq.virginia.gov

Matthew J. Strickler
Secretary of Natural Resources

David K. Paylor
Director
(804) 698-4000

July 24, 2020

VIA ELECTRONIC MAIL

Mr. Jody Hawks
Environmental Manager
BAE Systems, Ordnance Systems, Inc.
Radford Army Ammunition Plant
4050 Pepper's Ferry Road
Radford, Virginia 24141

**Re: Response to Third Notice of Deficiency for the Draft Final Human Health and Ecological Risk Assessment Report - Approval
Radford Army Ammunition Plant (RAAP), Radford, Virginia
EPA ID#: VA1210020730**

Dear Mr. Hawks:

The Virginia Department of Environmental Quality (DEQ) has completed the review of the Radford Army Ammunition Plant (RAAP) facility's *Response to the Third Notice of Deficiency for the Draft Final Human Health and Ecological Risk Assessment Report* (HHRA Third NOD Response) submission, dated and received on May 28, 2020. The HHRA Third NOD Response was submitted in response to the Third Notice of Deficiency for the Draft Final Human Health and Ecological Risk Assessment Report letter dated April 17, 2020.

Based on the review of the HHRA Second NOD Response the DEQ has determined that all comments have been resolved and the proposed revisions to the HHRA Report shall be incorporated and a draft final version of the HHRA Report will be sent to DEQ within 30 days for final approval (August 24, 2020).

If you have any questions concerning the information provided in this letter, please contact me at (804) 698-4467 or by email at Ashby.Scott@deq.virginia.gov.

Mr. Jody Hawks
Environmental Manager
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July 24, 2020

Sincerely,

A handwritten signature in black ink, appearing to read 'Ashby R. Scott', with a stylized, cursive script.

Ashby R. Scott
Hazardous Waste Permit Writer
Office of Financial Responsibility
and Waste Programs

Attachments:

Approved Notice of Deficiency Responses - Human Health Risk Assessment Report for the
Renewal of the Subpart X Open Burning Permit

cc: Central Hazardous Waste Files
Mindy Lemoine, EPA, Region III (3LC50)
Nichole Herschler, Rebecca Wright, DEQ BRRO
Leslie Romanchik, Kyle Newman, Brett Fisher. Brian Burton, DEQ, CO

Jim McKenna, Radford Army Ammunition Plant

Third Notice of Deficiency Addressing the Administrative Completeness of the Draft Human Health Risk Assessment Report for the Renewal of the Subpart X Open Burning Permit

1. **General Comment:** Please provide tables of all relevant data associated with the risk assessment including deposition rates, exposure point concentrations, exposure defaults, etc. for each scenario. These values should be provided in easy to review and verify formats to increase the transparency of the risk assessment. Currently this information is contained in an extensive series of spreadsheets that are password protected. Many of the above values are hard-coded into the spreadsheets, and some equations refer to hidden workbooks or cells that make verification of the calculated values difficult if not impossible. RAAP has communicated to DEQ that they consider these spreadsheets proprietary. However, they have not undergone review or approval from EPA. EPA software reviews require access to all aspects of coding and calculations before approval. DEQ has not been provided this level of access, and therefore on their own the spreadsheets do not provide the adequate level of documentation required to support the risk assessment. RAAP may still use the spreadsheets to perform the calculations, but robust and clear documentation must be provided of all inputs and approaches so final values can be easily verified both by DEQ and interested stakeholders. DEQ can provide examples of what would be considered adequate documentation if requested.

RAAP is encouraged to review the final NOD response letter for the protocol review to ensure all comments that were to be resolved in the final risk assessment have been addressed.

Note that because of the above limitations on this round of review, additional comments on the risk assessment are possible once the proper documentation is provided.

Radford Response 1-1 (Received October 25, 2019): All tables of relevant data associated with the risk assessment were included in the spreadsheets submitted as an appendix to the risk assessment report. These tables detailed every single input into the risk assessment calculations and document the transition of those inputs through the various fate and transport equations. It was our original intent to provide printouts of each of these spreadsheets to document the risk assessment results (as was done by other facilities in their risk assessment reports). However, the sheer magnitude of this assessment, which included assessment of 89 different constituents of potential concern (COPCs) under two different operating scenarios at 28 different receptor locations via multiple pathways made such a printout, approximately 3,000 pages, impractical. Instead, we provided the spreadsheets so that DEQ could walk through the calculations themselves and make their review easier.

DEQ is under the impression that there are hidden cells and worksheets that are integral to the risk assessment calculations that they cannot access. This is an incorrect impression. As an example, in Attachment 2 to this letter, we have provided a “Table of Contents” for each type of a receptor and a “roadmap” for one of the receptor evaluations – a resident receptor – to

help the reader navigate the information presented and to clearly demonstrate that all of the required data for evaluation of the correctness and completeness of the data presentation and calculations is provided, visible, and accessible. Furthermore, in response to NOD #2, below, we have provided a walk-through of the assessment of soil concentrations in one of the receptor pathways, with visual cues to help the reader in their understanding of the presentation. As shown in that example, all input tabs, concentration tabs, and receptor impact tabs are clearly labeled in the workbooks.

DEQ has communicated that they believe they can complete a review of the spreadsheets, the inputs, and the calculations, if they are provided the password for the files. The spreadsheets are proprietary and, to protect this trade secret from release in a FOIA request, were submitted in password protected format. We will consider, under separate cover and with a cover page claiming confidential business information, providing the password for the files to DEQ if DEQ can guarantee protection of the unlocked spreadsheets. As will be made clear in the CBI submittal, any non-password protected version of the spreadsheets is protected under the CBI submittal and should not be released to the public in a FOIA request.

DEQ Response 1-1: After discussion with DEQ, RAAP has agreed to provide separate tables with all relevant data. These tables will be reviewed upon submittal. Please note that the ultimate goal of the documentation is not only to allow for DEQ to verify the accuracy of the risk assessment, but also to provide other stakeholders a transparent way to reproduce its results and evaluate its inputs.

Radford Response 2-1 (Received January 30, 2020): As discussed in DEQ's Response #1-1 General Comment #1 above, RFAAP agreed to provide separate tables with the data requested. These tables were submitted to DEQ on 19 December 2019 and their receipt was acknowledged by DEQ on 27 December 2019. Pending comments on that submittal, no further response is required at this time.

DEQ Response 2-1: Discussion of this comment will be resolved through the separate comment chain regarding the HHRA Tables that were submitted on December 27, 2019.

DEQ Response 3-1: Comment was resolved and DEQ tentative approval was granted in a letter for the HHRA Tables was sent on June 4, 2020

2. **General Comment:** DEQ requests that in addition to the above revisions and submissions, RAAP provide clear tables containing media concentrations and all of the inputs used to derive them within two weeks of receiving these comments. The submitted spreadsheets calculate concentrations using hidden worksheets and cells making them difficult to verify. The media concentrations form the backbone of the risk assessment effort. DEQ would like to verify them early in the process to maximize the efficiency of the review and reduce the turnaround time required for any potential future revisions. For each burn scenario and exposure setting, please provide a table containing the following for each media evaluated:

- Each constituent evaluated in the risk assessment.
- The calculated media concentration of that constituent used in the risk assessment for that scenario.
- The values of all variables used in the calculation of those media concentrations and a separate table noting the source of all of those values.

These concentrations will also be used in the ecological risk assessment currently being performed by DEQ where applicable.

Radford Response 1-1 (Received October 25, 2019): The previous submittal clearly documented all media concentrations under each exposure scenario at each receptor location that was assessed and documented the values of all variables used in calculation of those media concentrations, along with their source. Each tab is clearly labeled with the media concentrations it presents. For example, all soil concentrations can be found on the tab labeled “Soil concentrations”; all drinking water concentrations can be found on the “Drinking Water Concentrations” tab; and all produce and animal product concentrations can be found on the so-named worksheets in each of the receptor assessment files that was submitted. As an example of this, the below details the presentation of the data for a resident receptor in a propellant burn at one of the assessed locations. The media concentrations for soil are provided in the example. A similar “road map” for each of the other media concentrations is provided in the example in the Attachment 2.

Referencing the worksheet labeled “Soil Concentrations”, the second column of the tab (Column B) lists out each of the 89 constituents that were evaluated in the assessment (a small subset is shown here for this explanation). The soil concentrations for tilled and untilled soil and for carcinogenic COPCs and non-carcinogenic COPCs are then presented in columns E through J of the spreadsheet. The deposition term, which is a necessary input to the soil concentrations is provided for tilled and untilled soil in columns C and D of the spreadsheet. The resulting media concentration value for every single COPC is provided for each of the different concentration bases listed above.

Continuing with this example, the top of the tab shown references the formula that was used to perform the calculation. (For example, Columns E through J are determined using equations B-1-1, B-2-1, and B-3-1 from the USEPA HHRAP guidance). Looking

	A	B	C	D	E	F	G	H	I	J
1										
2	No.	COPC	Deposition Term B-1-1/B-2-1/ B-3-1 Ds (non-tilled)	Deposition Term B-1-1/B-2-1/ B-3-1 Ds (tilled)	Carcinogen Soil Concentration B-1-1/B-2-1/ B-3-1 Cs (non-tilled) for T2 <= tD	Carcinogen Soil Concentration B-1-1/B-2-1/ B-3-1 Cs (non-tilled) for T2 > tD	Carcinogen Soil Concentration B-1-1/B-2-1/ B-3-1 Cs (tilled) for T2 <= tD	Carcinogen Soil Concentration B-1-1/B-2-1/ B-3-1 Cs (tilled) for T2 > tD	Noncarcinogen Soil Concentration B-1-1/B-2-1/ B-3-1 Cs _{ND} (non-tilled)	Noncarcinogen Soil Concentration B-1-1/B-2-1/ B-3-1 Cs _{ND} (tilled)
3			mg /kg soil - yr	mg /kg soil - yr	mg/kg soil	mg/kg soil	mg/kg soil	mg/kg soil	mg/kg soil	mg/kg soil
4										
5										
6	1	MERCURY	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
7	2	MERCURIC CHLORIDE	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
8	3	METHYL MERCURY	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
9	4	LEAD	2.9267E+00	2.9267E-01	2.6028E-02	2.6028E-02	2.5226E-01	2.5226E-01	2.6056E-02	2.5995E-01
10	5	ACENAPHTHENE	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
11	6	ACETALDEHYDE	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
12	7	ACETONE	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
13	8	ACETONITRILE	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
14	9	ACROLEIN	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
15	10	ACRYLONITRILE	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
16	11	ANTHRACENE	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
17	12	ANTIMONY	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
18	13	ARSENIC	5.9742E-03	5.9742E-04	5.5610E-08	5.5610E-08	5.5605E-07	5.5605E-07	5.5610E-08	5.5607E-07

↑ COPCs ↑ Term ↑ Deposition ↑ Soil Concentrations

at these equations, the following are used as inputs into the calculations:

- Deposition term (Ds): This is shown on the same page as the soil concentrations
- The COPC-specific soil loss constants (ks): This is calculated and displayed on the tab labeled "Loss". The values for each individual COPC are clearly defined, as shown below.

	A	B	C	D	E	F	G	H	I	J	K
1	No.	COPC	COPC Soil Loss Constant Due to All Processes B-1-2/B-2-2/B-3-1 ks (non-tilled) yr ⁻¹	COPC Soil Loss Constant Due to All Processes B-1-2/B-2-2/B-3-2 ks (tilled) yr ⁻¹	COPC Loss Constant Due to Mistic and Abiotic Degradation Appendix A-3 yr ⁻¹	COPC Loss Constant Due to Surface Runoff B-1-4/B-2-4/B-3-4 ksr (non-tilled) yr ⁻¹	COPC Loss Constant Due to Surface Runoff B-1-4/B-2-4/B-3-4 ksr (tilled) yr ⁻¹	COPC Loss Constant Due to Leaching B-1-5/B-2-5/B-3-5 ksl (non-tilled) yr ⁻¹	COPC Loss Constant Due to Leaching B-1-5/B-2-5/B-3-5 ksl (tilled) yr ⁻¹	COPC Loss Constant Due to Volatilization B-1-6/B-2-6/B-3-6 ksv (non-tilled) yr ⁻¹	COPC Loss Constant Due to Volatilization B-1-6/B-2-6/B-3-6 ksv (tilled) yr ⁻¹
2											
3											
4											
5	1	MERCURY	4.1214E+00	4.2792E-02	0.0000E+00	1.4449E-01	1.4449E-08	2.8713E-08	2.8713E-04	4.1039E+00	4.1039E-01
6	2	MERCURIC CHLORIDE	3.0243E-04	3.0230E-05	0.0000E+00	2.5187E-04	2.5187E-05	4.9511E-05	4.9511E-06	2.8046E-08	2.8046E-10
7	3	METHYL MERCURY	2.6924E-03	2.5241E-04	0.0000E+00	2.0952E-03	2.0952E-04	4.1023E-04	4.1023E-05	1.8699E-04	1.8699E-06
8	4	LEAD	1.1241E+02	1.1299E+00	0.0000E+00	1.6194E-01	1.6194E-08	3.1903E-08	3.1903E-04	1.1239E+02	1.1239E+00
9	5	ACENAPHTHENE	2.9408E+00	2.4865E+00	2.4802E+00	1.3332E-01	1.3332E-03	2.6103E-03	2.6103E-04	4.4488E-01	4.4488E-03
10	6	ACETALDEHYDE	7.4722E+04	7.5855E+02	0.0000E+00	1.0526E+02	1.0526E+01	2.0610E+01	2.0610E+00	7.4596E+04	7.4596E+02
11	7	ACETONE	2.3348E+03	6.6491E+01	3.6140E+01	6.6368E+01	6.6368E+00	1.3033E+01	1.3033E+00	2.2391E+03	2.2391E+01
12	8	ACETONITRILE	4.8718E+04	3.0793E+01	9.0302E+06	1.6602E+02	1.6602E+01	2.0793E+01	2.0793E+00	4.8532E+04	4.8532E+01
13	9	ACRYLONITRILE	5.1637E+04	5.3673E+01	9.0302E+06	9.9615E+01	9.9615E+00	1.9504E+01	1.9504E+00	5.1579E+04	5.1579E+01

- Various constants that are not site-specific, including the time period of deposition (tD), the time period at the beginning of combustion (T1), the COPC soil loss constant due to erosion (kse), the Universal gas constant (R), the ambient

temperature (T_a), and the solids particle density (ρ_s). These can be found on the tab labeled “Constants.” As shown below, each variable is clearly defined, valued, and sourced.

- Various constants that are site-specific, including the soil water content (Θ_{sw}), the annual average surface water runoff (RO), precipitation (P), irrigation (I), and evapotranspiration (E_v) rates. These can be found on the tab labeled “Site-Specific.” As shown below, each variable is clearly defined, valued, and sourced.

	A	B	C	D	E
1	Variable	Description	Units	Value	Source
2	Θ_{sw}	Soil volumetric water content	mL water/cm ³ soil	0.2	USEPA Default (Use 0.1 for “very sandy soil” and 0.3 for “heavy loam/clay soils”)
3	RO	Average annual surface runoff from pervious areas	cm/yr	44	From Groundwater Atlas of the United States
4	P	Average annual precipitation	cm/yr	113	From Journal of the American Water Resources Association, Vol. 48, 1, 26 December 2012
5	I	Average annual irrigation	cm/yr	12.5	From Baes, 1984 and 1987 Mercury Study Report Congress (Eastern States), B2.5
6	E_v	Average annual evapotranspiration	cm/yr	72.885	From Journal of the American Water Resources Association, Vol. 48, 1, 26 December 2012
7	OC _{sed}	Fraction of organic carbon in bottom sediment	---	0.04	B-4-28, USEPA OSW recommendation or site-specific information
8	AT	Averaging time	years	70	C-17, USEPA OSW recommendation or site-specific information

- Constants that are specific to the exposure exposure scenario being assessed. In the case of determining soil concentrations, the scenario-specific constant is the exposure duration (ED) for the adult and child receptors. These are clearly shown on the “Receptors” tab where all scenario-specific values are provided.

7	Variable	Description	Units	Adult	Child	Override Adult	Override Child
8	CR _{soil}	Consumption rate for soil	kg/day	0.0001	0.0002	NA	NA
9	F _{soil}	Fraction of soil that is consumed	---	1	1	NA	NA
10	BW	Body weight	kg	70	17	NA	NA
11	A	Skin surface area	cm ²	25,000	9,500	NA	NA
12	CR _{ag}	Consumption rate for aboveground exposed produce	kg/kg-day	0.00032	0.00077	NA	NA
13	CR _{pg}	Consumption rate for aboveground protected produce	kg/kg-day	0.00061	0.0015	NA	NA
14	CR _{bg}	Consumption rate for belowground produce	kg/kg-day	0.00014	0.00023	NA	NA
15	F _{ag}	Fraction of produce that is contaminated	---	0.25	0.25	NA	NA
16	CR _{beef}	Consumption rate for homegrown beef	kg/kg-day	0	0	NA	NA
17	CR _{milk}	Consumption rate for homegrown milk	kg/kg-day	0	0	NA	NA
18	CR _{pork}	Consumption rate for homegrown pork	kg/kg-day	0	0	NA	NA
19	CR _{poultry}	Consumption rate for homegrown poultry	kg/kg-day	0	0	NA	NA
20	CR _{eggs}	Consumption rate for homegrown eggs	kg/kg-day	0	0	NA	NA
21	F _{animal}	Fraction of animal product that is contaminated	---	0	0	NA	NA
22	CR _{fish}	Consumption rate for fish	kg/kg-day	0	0	NA	NA
23	F _{fish}	Fraction of fish that is contaminated	---	0	0	NA	NA
24	CR _{dw}	Rate of consumption of drinking water	L/day	1.4	0.67	NA	NA
25	F _{dw}	Fraction of drinking water that is contaminated	---	1	1	NA	NA
26	AF	Adherence factor (dermal)	mg/cm ² /event	0.0503	0.026	NA	NA
27	ED	Exposure duration	years	30	6	NA	NA
28	EF	Exposure frequency	days/year	350	350	NA	NA
29	IR	Inhalation rate	m ³ /hr	0.83	0.3	NA	NA
30	ET	Exposure time	hr/day	24	24	NA	NA

RAAP believes that part of the difficulty in reviewing this data expressed in the above comment is the sheer magnitude of the assessment that was performed. DEQ provided an example of a report submitted by another facility. In reviewing that report, we note that the specific tables and data referenced by DEQ in this NOD took some 250 pages of print to express in the example report (reference Appendix B of the example report provided). From reviewing that report, it appears as if that facility assessed risk of five different types of receptors (a receptor being inclusive of an adult and a child) at one location under one operating scenario. Conversely, RAAP assessed the risk to eight different receptors at a total of 13 different locations under two separate operating scenarios. This difference is understandable as the example report is generated from a facility located in a very isolated area in simple terrain, whereas RAAP is situated in between three significant population centers in complex terrain. Extrapolating the page-count upwards from the five evaluations in the example report to the 28 different evaluations in the RAAP report, and, assuming that the page count per evaluation is similar, the 250 pages of print in the example report would translate to over 1,400 pages of print to express the same data in the same format for the RAAP study. Considering that the data requested is already presented in the April submittal, albeit not in the exact same form as the example DEQ recently provided, this request is unreasonable in the timeframe requested by DEQ. Should DEQ insist on the data being presented in the exact same format as the example report, we estimate that approximately

three months would be required to transform the previous tabled data into the format provided in the example report. (Note that depending on when the request is received, additional time may be required due to resource availability, holiday schedule, *etc.*). Please provide additional direction to RAAP if DEQ is going to require the data to be presented in the exact format as the example report provided by DEQ. As was previously communicated, RAAP is willing to walk DEQ through the submitted supporting documentation via a WebEx or in person at VDEQ's office, if desired.

These concentrations will also be used in the ecological risk assessment currently being performed by DEQ where applicable.

In response to DEQ's relation of this data to the ecological risk assessment, please note that the anticipated location for assessment of the ecological scenarios is not the same as the location for assessment of the human health scenarios. Therefore, the media concentrations in the human health submittal will be different than the media concentrations for the ecological assessment and cannot be used in the ecological assessment per the approved protocol.

DEQ Response 1-1: Please see the response to NOD Response 1 above.

Additionally, RAAP's contention that these concentrations would not be applicable to the SLERA are incorrect. The figure submitted as part of the protocol indicated that all terrestrial areas fall into the "forest/prairie" designation, so the location of maximum deposition would be appropriate location to evaluate risks to terrestrial ecological receptors. The maximum impacted water body would also be the appropriate endpoint for aquatic receptors.

DEQ Response 3-1: Comment was resolved and DEQ tentative approval was granted in a letter for the HHRA Tables was sent on June 4, 2020

Radford Response 2-1 (Received January 30, 2020): As discussed in DEQ's Response #1-1 General Comment #1 above, RFAAP agreed to provide separate tables with the data requested. These tables were submitted to DEQ on 19 December 2019 and their receipt was acknowledged by DEQ on 27 December 2019. Pending comments on that submittal, no further response is required at this time. Any issues related to the ecological risk assessment will be reviewed and discussed when DEQ provides the results of the ecological assessment they are conducting.

DEQ Response 2-1: Discussion of this comment will be resolved through the separate comment chain regarding the HHRA Tables that were submitted on December 27, 2019.

3. **General Comment:** Please use all default RSL exposure values and defaults as agreed to during protocol discussions. It appears that the averaging time used in the calculations for carcinogenic risk to children used a 70 year averaging time when it should be the entire time of exposure for these receptors as per the RSL equations. This resulted in an evaluation that assumed exposure of just 6 years over the entire lifetime of the receptor, underestimating risk

by orders of magnitude in some instances. Other exposure factors like body weight also do not appear to reflect current EPA defaults. RAAP should review all of these exposure default values and recalculate risks as necessary.

Radford Response 1-1 (Received October 25, 2019): All of the constituent-specific values utilized in the risk assessment were updated per the latest edition of the EPA Region 3 RSL, as was directed by DEQ. These updated values are provided in the “Constituents.xls” spreadsheet that was provided with the risk assessment submittal.

The specific averaging time referenced above was discussed in Section 4.3.3 of the approved Protocol. The following averaging times/exposure durations were approved:

- Exposure at a residence occurs 350 days per year, 24 hours per day for each of the general exposure scenarios, based on the assumption that each individual spends at least two weeks away per year;
- The child is assumed to be in residence from ages one to six inclusive. Adults are assumed to be in residence for 30 years. Subsistence farmers are assumed to be in residence for 40 years;
- Exposure at the elementary school is assumed to occur eight hours per day, 180 days per year;
- Exposure at the day care is assumed to occur eight hours per day, 350 days per year;
- Children are assumed to attend day care for six years, from birth through six years old;
- Elementary school students are assumed to attend for five years, from age six through ten;
- Adults and children at the hospital are exposed 24 hours per day for 7 consecutive days;
- Exposure at the nursing home is assumed to occur 24 hours per day, 350 days per year; and
- Elderly receptors are assumed to reside in the nursing home for three years, based on data collected from long-term care insurance providers (USDHHC, 2004).

The specific body weight referenced above was discussed in Section 4.3.2 of the approved Protocol. As stated therein: “For all adult receptors, this MPRA will use a body weight of 70 kilograms, as recommended in the HHRAP. For child receptors, the MPRA will use an average body weight of 17 kilograms, as recommended in the HHRAP.”

Having reviewed the historical NOD communication on the risk assessment protocol, it is noted that DEQ provided specific permission to RAAP to use the exposure assumptions and scenarios specified in the USEPA HHRAP guidance (reference NOD 31), absent a few modifications that DEQ provided to specific exposure durations. The assessment was performed consistent with this direction. Please also reference the discussions associated with NOD26.

DEQ Response 1-1: During review of the original protocol, the responses to Comment 22 stated:

“Per the discussions with RAAP on March 31, 2016, RAAP will provide exposure/input values which are different from the ones provided in the RSL table and EPA HHRAP with text justifying the use of these non-default values. For exposure defaults, the EPA RSL values will supersede EPA HHRAP where available [emphasis added]. All the input values used in the calculation will be included in the HHRA report. This comment also applies to Response 30.”

RAAP goes on to respond “It is RAAP’s understanding that the above NOD serves as a recommendation/request for the risk assessment report (RAR), not the RAP. Therefore, this NOD is satisfied in terms of the RAP.” If the specific line from Section 4.3.3 referenced in the current NOD response was not identified in subsequent review (after DEQ review staff changed) it was because of this language. DEQ has been very flexible with RAAP to date, and has been open to revisions/deviations from the protocol related to RAAP oversights or new information with justification. Similar courtesy should be extended for previously communicated expectations for the HHRA, especially as the exposure defaults in question relate to the technical accuracy of the risk assessment. NOD Comment 31 seemed to be in reference to the exposure durations, not default parameters such as body weight that would have been covered by NOD Comment 22.

As discussed in the response to NOD Response 1, RAAP will provide all relevant data including exposure defaults as originally submitted. DEQ will review this submittal and identify all required revisions once the data have been provided in a more easily reviewable format.

Radford Response 2-1 (Received January 30, 2020): As discussed in DEQ's Response #1-1 General Comment #1 above, RFAAP agreed to provide separate tables with the data requested. These tables were submitted to DEQ on 19 December 2019 and their receipt was acknowledged by DEQ on 27 December 2019. Pending comments on that submittal, no further response is required at this time.

DEQ Response 2-1: Discussion of this comment will be resolved through the separate comment chain regarding the HHRA Tables that were submitted on December 27, 2019. Note that the averaging time issue identified in the comment was not resolved in a conference call on March 24, 2020. The averaging time is not 70 years for non-cancer risks.

Section 6.6 of the 2005 EPA HRAP guidance states “For noncarcinogenic COPCs, we generally recommend using a value of exposure duration (years-as specified for each receptor in Section 6.4).”

Radford Response 3-1 (Received May 28, 2020): We acknowledge that most of the issues raised in this comment will be addressed through the separate comment chain on the HHRA tables. However, we did want to address DEQ’s secondary comment regarding the averaging time for non-cancer risks. The issue of averaging time for non-cancer risks was raised by DEQ in the first Notice of Deficiency (NOD) on the Draft Final HHRA Report issued on 28 February 2020. In response to Comment #15 in that NOD letter, we referred DEQ to Section 5.4 of the risk assessment report. As stated in that section, the averaging time for cancer risk calculations is based on a lifetime exposure of 70 years. For hazard calculations, the averaging time is set equal to the exposure duration.

DEQ Response 3-1: DEQ has reviewed the response and the comment is now satisfied.

4. **General Comment:** The list of COCs was modified from the protocol to remove several compounds considered products of incomplete combustion (PICs). DEQ has agreed to consider their removal from the risk assessment, however RAAP must provide adequate documentation that the formation of these PICs is not possible given the waste streams treated originating both from RAAP and any tenants that may utilize open burning at the facility. For compounds where their formation cannot be ruled out, RAAP will retain them as COCs, make a good faith effort to acquire adequate data to estimate their emissions, and if no data are available to do so with confidence RAAP will perform a qualitative assessment of those compounds in the risk assessment.

Radford Response 1-1 (Received October 25, 2019): Please reference RAAP’s response to this comment that is provided in Attachment 3 of this letter.

DEQ Response 1-1: DEQ has reviewed the attachment and provided comments in a separate communication to RAAP on November 11, 2019.

Radford Response 2-1 (Received January 30, 2020): RFAAP submitted a response to DEQ's November 11, 2019, correspondence in a submittal provided on 19 December 2019. Receipt of this submittal was acknowledged by DEQ on 27 December 2019. Pending comments on that submittal, no further response is required at this time.

DEQ Response 2-1: Based on separate discussions regarding the attachment provided, this comment is considered satisfied.

5. **General Comment:** Please include a qualitative discussion of priority pollutants as per the 2005 HRAP and initial requests from DEQ.

Radford Response 1-1 (Received October 25, 2019): Please clarify to which pollutants DEQ is referring. The term “priority pollutants” can mean a variety of different pollutants depending upon the Federal regulation that is being referenced. Note that we did review the USEPA’s HHRAP guidance and cannot find the term priority pollutant used in the document.

DEQ Response 1-1: “Priority pollutants” is in reference to the NAQS standards such as particulate matter or NO_x. However, the correct nomenclature from the Clean Air Act is “criteria pollutants”. RAAP shall include the discussion based on the pollutants which are classified as criteria pollutants under the Clean Air Act.

Radford Response 2-1 (Received January 30, 2020): We appreciate the clarification. We have added a discussion to Section 7.2 of the risk assessment report to address the potential impact from criteria pollutants as requested.

DEQ Response 2-1: The added text should include a discussion of particulate matter (PM), which is also a criteria pollutant. Open burning is a significant source of this pollutant, and the potential impact of these emissions should be discussed in the risk assessment. While certain classifications associated with these sources may preclude a direct comparison to the criteria, an effort to evaluate risks associated with PM emissions from the OBG should be made.

Radford Response 3-1 (Received May 28, 2020): Particulate matter from combustion sources is generally characterized as a mixture of non-combustible emission products and metals. Most of this particulate matter falls in the micron to sub-micron category and is generally characterized as PM_{2.5}. The cancer risk and hazard quotient evaluation included in the HHRA already addressed the impact of the PM-metallic fraction on the surrounding community. For the non-metallic fraction, a qualitative assessment can be performed by comparing the modeled PM_{2.5} emissions from the OBG to the PM_{2.5} National Ambient Air Quality Standards (NAAQS).

The site-specific emissions testing performed at the RFAAP OBG included an evaluation of PM_{2.5} emissions from each of the open burning scenarios. The testing found that the PM_{2.5} emissions were higher from the propellant burns than the skid burns. For propellant burns, the sampling reported an emissions factor of 0.0155 pounds of PM_{2.5} per pound of waste (lb/lb); for skid burns, the sampling reported an emissions factor of 0.0073 lb/lb. Applying these emission factors at the areas of highest particle-phase air concentration results in an annual average PM_{2.5} air concentration of 0.265 µg/m³ for propellant burns, and a PM_{2.5} concentration of 0.0662 µg/m³ for skid burns.

The PM_{2.5} NAAQS to ensure protection of public health and the environment. The primary standards are designed to protect public health, including sensitive populations. The secondary standards are designed to protect public welfare, including protection against decrease visibility and damage to animals, crops, and vegetation. The current primary and secondary NAAQS for PM_{2.5} are 12.0 µg/m³ and 15.0 µg/m³, respectively. Comparing the NAAQS and

the modeled $PM_{2.5}$ concentrations from both burn scenarios, it does not appear as if the $PM_{2.5}$ emissions from the OBG operations pose a threat to human health or the environment. The highest modeled $PM_{2.5}$ concentration is only 2.2 percent of the primary NAAQS and 1.8 percent of the secondary NAAQS. Furthermore, these concentrations assume operation 365 days per year, which is not realistic. Therefore, the actual $PM_{2.5}$ concentrations and impact should be even less than this prediction.

DEQ Response 3-1: DEQ has reviewed the response and the comment is now satisfied.

6. **Section 2.1.1:** Please include more information regarding the site specific emissions testing. This should include a description of the methodology and limitations as well as a table of measured concentrations. RAAP should consider including the final report on the emissions sampling as an appendix or attachment to the risk assessment since it is a critical source of data used in its evaluations.

Radford Response 1-1 (Received October 25, 2019): RAAP concurs additional information from the site specific emission testing would be beneficial to include in the report. The test plan along with the final report from the testing will be submitted under separate cover once approved through export control to be included as appendices.

DEQ Response 1-1: A summary of this information should be included in the text of main report.

Radford Response 2-1 (Received January 30, 2020): We have added a discussion to Section 2.1.1 of the risk assessment report to summarize the site-specific emissions testing that was done.

DEQ Response 2-1: DEQ has reviewed the revised text in Section 2.1.1 and the comment is now satisfied.

7. **Table 5-1:** Soil ingestion rates are different for the school and daycare scenarios. Please provide the rationale for the differences in soil ingestion rates between these two scenarios.

Radford Response 1-1 (Received October 25, 2019): Originally, RAAP had proposed to model the school and daycare scenarios the same, with identical exposure variables, including ingestion rates. However, during negotiation of the protocol, DEQ indicated that RAAP should run two separate exposure scenarios (one for daycares and one for schools) (reference NOD 24). In our response, RAAP pointed out that this was counter to USEPA recommendations in the USEPA HHRAP guidance and requested that DEQ provide specific exposure criteria for each.

DEQ was concerned in these discussions that the age range of daycare children is different than that of school age children and, as such, requires different input data be used that corresponds with the age group assessed. The very small difference (0.0002 kg/day for daycare versus

0.0001 kg/day for elementary school children) reflects a slight increased rate for daycare children given the tendency of younger, toddler-aged children to mouth objects and suck on their hands and fingers more than those of school-aged children. This was done in accordance with the approved protocol.

DEQ Response 1-1: Please revise the table to include this rationale from the response: “The very small difference (0.0002 kg/day for daycare versus 0.0001 kg/day for elementary school children) reflects a slight increased rate for daycare children given the tendency of younger, toddler-aged children to mouth objects and suck on their hands and fingers more than those of school-aged children.”

Radford Response 2-1 (Received January 30, 2020): We have added a discussion to Section 5.2.2 of the risk assessment report to clarify the basis behind the different ingestion rates.

DEQ Response 2-1: DEQ has reviewed the revised text in Section 5.2.2 and the comment is now satisfied.

8. **Section 5.5:** Body weight values described in this section do not match updated EPA exposure defaults that are reflected in the RSL calculator (see Comment 3). Please also include the source of the body weight value selected for the elementary school child receptor.

Radford Response 1-1 (Received October 25, 2019): Body weights were included in the approved risk assessment protocol, as discussed above under General Comment #3. The specific body weight referenced above was discussed in Section 4.3.2 of the approved Protocol. As stated therein: “For all adult receptors, this MPRA will use a body weight of 70 kilograms, as recommended in the HHRAP. For child receptors, the MPRA will use an average body weight of 17 kilograms, as recommended in the HHRAP.”

DEQ Response 1-1: Please see the response to Comment 3 and the discussions of the RAP NOD concerning Comment 22.

Radford Response 2-1 (Received January 30, 2020): As discussed in DEQ's Response #1-1 General Comment 41 above, RFAAP agreed to provide separate tables with the data requested. (Note that the body weight values were specified in the tables submitted. The source of each body weight value was the HHRAP, as stated above). These tables were submitted to DEQ on 19 December 2019 and their receipt was acknowledged by DEQ on 27 December 2019. Pending comments on that submittal, no further response should be required at this time. If, after their review, DEQ wishes us to modify the body weight assumptions, we will incorporate those changes to any others determined necessary by DEQ's review of our 19 December 2019 submittal.

DEQ Response 2-1: DEQ has reviewed the revised tables and after a the discussion with RAAP during a conference call on March 26, 2020 to clarify the reasoning behind the body weight values used in the tables the comment is now satisfied.

9. **Section 6.4.2:** The meaning of the following sentence is unclear: “Overall, these two, day care locations had lower air modeling results than Cedarwood Preschool.” When referring to air modeling results, is this a reference to associated risk numbers, vapor phase concentrations, or some other aspect of modeling? Please clarify the text.

Radford Response 1-1 (Received October 25, 2019): This comment is further explained in the air modeling results section of the report (Section 4.2.1) and, in particular, is detailed in the footnote to Table 4-7. As noted in the footnote, the hourly particulate phase concentrations from New River Community Action Center were higher than those from Cedarwood Preschool in the propellant burns. All other air modeling results for Cedarwood preschool (*i.e.*, annual air concentrations and deposition rates and hourly air concentrations from each modeled phase – particulate, particulate-bound, and vapor) were higher than those for the New River Community Action Center. Therefore, for assessment of risk, the hourly particle phase concentrations from the New River Community Action Center were substituted for those at Cedarwood Preschool and were used along with the remainder of the air modeling data for Cedarwood Preschool to assess risk at that location from propellant burns. Likewise, the hourly particulate phase air concentrations were higher at St. Mary’s Little Angels in the skid burns; however, Cedarwood Preschool had higher results for all other air modeling parameters. The table below provides a comparison for DEQ’s reference. (Please note that the results for all locations were previously submitted to DEQ under separate cover with the remainder of the air modeling results and files).

		Day Care New River Community Action 539500E, 4110500N	Day Care St. Mary's Little Angels 547500E, 4119500N	Day Care Cedarwood Preschool 551500E, 4112500N
Propellant Burns				
Cyv	Unitized yearly average air concentration from vapor phase	0.000065	0.00054	0.00073
Cyp	Unitized yearly average air concentration from particle phase	0.000075	0.00057	0.00068

Chv	Unitized hourly average air concentration from vapor phase	1.28	1.96	2.30
Chp	Unitized hourly average air concentration from particle phase	1.03	0.95	0.66
Dydp	Unitized yearly average deposition from particle phase	0.00011	0.00084	0.0012
Skid Burns				
Cyv	Unitized yearly average air concentration from vapor phase	0.000066	0.00052	0.00062
Cyp	Unitized yearly average air concentration from particle phase	0.000090	0.00067	0.00069
Chv	Unitized hourly average air concentration from vapor phase	0.74	1.11	1.29
Chp	Unitized hourly average air concentration from particle phase	1.28	1.65	1.05
Dydp	Unitized yearly average deposition from particle phase	0.00014	0.0010	0.0014

DEQ Response 1-1: Please revise the section to reflect the description included in this response.

Radford Response 2-1 (Received January 30, 2020): We have added a footnote to Table 4-7 in Section 4.2.2 and modified the discussion to Section 6.4.2 of the risk assessment report to further clarify the assessment that was performed and the data that was used in that assessment.

DEQ Response 2-1: DEQ has reviewed the revised text in Table 4-7 and Section 4.2.2 and the comment is now satisfied.

10. **Table 7-1, Emission Factors, Second Row:** The AP-42 data were not generated through open burning or detonation. Most of the AP-42 data were derived from “bang box” studies not reflective of the treatment of the RAAP waste stream. Drone testing revealed that the AP-42 data underestimated some emissions and overestimated others. This discussion should include a comparison of the AP-42 data to the data from the drone flyer sampling to more accurately describe uncertainties.

Radford Response 1-1 (Received October 25, 2019): The most accurate emission factors are derived from site-specific data. For constituents that were analyzed in the drone flyer sampling, site-specific emission factors were utilized. When site-specific emission factors were not available, RAAP utilized AP-42 emission factors. EPA considers the AP-42 data to be the best available data for OB/OD when site-specific data is not available. We have added a reference to the USEPA 2002 permitting guidelines and a discussion of the comments on the BangBox data to the table in the risk assessment report to clarify and describe any uncertainties.

DEQ Response 1-1: The revised text still refers to the bang box data as being derived from “open burning or detonation” when the bang box data are not representative of that scenario. The original comment requested a comparison of the AP-42 data to the site specific drone data for constituents where available. This discussion could be on a more general level, but an understanding of whether the AP-42 under or overestimates emissions is useful for evaluating the uncertainties present in the risk assessment.

Radford Response 2-1 (Received January 30, 2020): DEQ is incorrect in their understanding of the bang box data that was used in development of the AP-42 emissions factors. The testing is referenced repeatedly in the document "Draft Final Open Burning/Open Detonation Permitting Guidelines" prepared by TetraTech for the USEPA (USEPA,2002). As explained in Section 4 of this reference, on page 4-5, "the US. Army has conducted numerous **OB/OD emission tests** [emphasis added] within a chamber (i.e., BangBox) for the Military Services. Results from many of these tests have been compiled and validated by the EPA in Emission Factors for the Disposal of Energetic Materials by Open Burning and Open Detonation (OB/OD), **the best available OB/OD emission factor database** [emphasis added] ...Emission tests included treatment of bulk propellants, bulk explosives, dunnage, and munition items."

In response to DEQ's original comment, we have added a general discussion to Section 7.2.2 on the AP-42 data, as it compares to the site-specific data and the potential of either data set to overestimate or underestimate risk.

DEQ Response 2-1: The revised text is appropriate and satisfies key portions of the comment. However, the text should include additional information regarding how the

difference in environmental conditions between an enclosed chamber and open air burning may impact the results of the bang box studies for COCs not evaluated through drone testing.

Radford Response 3-1 (Received May 28, 2020): The biggest differences between combustion in an enclosed chamber and the open burning scenario is the availability of oxygen. In an enclosed chamber, the only oxygen available to support the combustion process is that which is supplied via a combustion air source, such as a blower or fan that injects outside air into the chamber. This rate-limited supply of oxygen can result in an oxygen deficiency and can lead to incomplete combustion. In the open-air environment, the air source is not limited, as any amount of oxygen required can easily be extracted from the ambient air. As a result, open-air combustion should generally result in more complete combustion than combustion in an enclosed chamber. When we consider how rapidly energetic materials consume oxygen in a combustion process, this difference is magnified. Therefore, using AP-42 factors for organic emissions from combustion of energetic material in an enclosed-chamber should result in a high-bias to the predicted emissions and the resulting risk. Not only do the site-specific emission factors represent the combustion of RFAAP-product at the RFAAP site, they also represent open-air combustion and will generally reflect the more complete combustion that can be obtained without oxygen supply limitations. Unfortunately, site-specific emission factors were not available for all of the organic compounds included in the risk assessment. Emissions of polynuclear aromatic hydrocarbons (PAHs) and phthalates, which tend to be drivers in most risk assessments because they are particularly harmful to the environment, were based on AP-42 factors. Therefore, the risk from these compounds is likely overestimated.

DEQ Response 3-1: DEQ has reviewed the response and the comment is now satisfied.

11. **Table 7-1, Dispersion/Deposition Modeling:** The OBODM software has some significant limitations in comparison to other models. Please include a more detailed description of the uncertainties associated with this software. Inaccurate modeling could impact the accuracy of some of the exposure scenarios, since suitability for the exposure scenario was a consideration in the selection of the locations used in the risk assessment. Please also note the use of surrogate compounds to estimate deposition rates and vapor concentrations, which could over or underestimate risks.

Radford Response 1-1 (Received October 25, 2019): As part of the protocol development and completion of the air modeling, RAAP submitted an air modeling sensitivity analysis that compared OBODM and AERMOD and discussed the limitations and advantages of each. This document is part of the administrative record for this permitting action. Therefore, we have added a reference to it in the risk assessment report for those who wish to have a better understanding of the uncertainties that OBODM introduced to the study.

DEQ Response 1-1: These sensitivities should be directly addressed in the RAR since they have direct bearing on the results of the risk assessment. The sensitivity analysis by itself is

focused on the deposition and dispersion aspects of the modeling, not the ensuing risks which are influenced by the chemical makeup and toxicity of the releases. The RAR should be providing a narrative that helps puts this information into context for risk management decisions.

Radford Response 2-1 (Received January 30, 2020): We have added additional language to Section 7.2.4 of the risk assessment report to address this comment.

DEQ Response 2-1: DEQ has reviewed the revised text in Section 7.2.4 and the comment is now satisfied.

12. **Table 7-1, Calculation of Media Concentrations:** Media concentrations are also heavily influenced by the accuracy of the dispersion and deposition modeling. Please note these potential uncertainties.

Radford Response 1-1 (Received October 25, 2019): RAAP concurs with this statement. We have added a row to Table 7-1 to account for this uncertainty.

DEQ Response 1-1: Please see response to Comment 11.

Radford Response 2-1 (Received January 30, 2020): We have added additional language to Section 7 of the risk assessment report to address this comment. (See changes to Section 7.2.4 and 7.2.5)

DEQ Response 2-1: DEQ has reviewed the revised text in Sections 7.2.4 and 7.2.5 and the comment is now satisfied.

13. **Table 7-1, Presence of Subsistence Fisher:** This description does not speak to the presence of these types of fishermen. These receptors are evaluated separately from recreational fishermen because their consumption rates are significantly higher than “typical” freshwater anglers. Data for these receptors are highly variable, and have the potential to over or underestimate consumption rates depending on the population. Please revise this description accordingly.

Radford Response 1-1 (Received October 25, 2019): Prior to conduct of the risk assessment, RAAP reviewed various angler studies to evaluate the likely presence of a subsistence fisher in the assessment area. We included data on these studies in the risk assessment protocol (See Section 1.4 of the risk assessment protocol) but were expressly directed by DEQ that such data could not be used to alter exposure assumptions. Therefore, we did not make any adjustments to account for this and reduce the uncertainty in the calculation of risk to fishermen in the area. We have added a reference to the fishing reports to the table for completeness. (The actual references themselves were already included in Section 8).

DEQ Response 1-1: DEQ concurs with RAAP's response and the comment is now satisfied.
Radford Response 2-1 (Received January 30, 2020): Based on DEQ's comment above, no further action is required in response to this NOD.

DEQ Response 2-1: Comment satisfied.

14. **Table 7-1, Values Used for Cancer Slope Factors and Reference Doses:** Extrapolation of toxicity data from animal studies also has the potential to underestimate risk. EPA utilizes uncertainty factors which usually result in overestimations of toxicity, however the toxicity for some compounds may be underestimated. Please revise this description accordingly.

Radford Response 1-1 (Received October 25, 2019): We have revised the table to indicate that this may overestimate or underestimate risk.

DEQ Response 1-1: DEQ concurs with RAAP's response and the comment is now satisfied.

Radford Response 2-1 (Received January 30, 2020): Based on DEQ's comment above, no further action is required in response to this NOD.

DEQ Response 2-1: Comment satisfied.

15. **Section 7.2:** Please include a description of the uncertainties associated with the evaluated distribution of skid vs. propellant burns.

Radford Response 1-1 (Received October 25, 2019): We do not understand DEQ's request on this comment. The skid burn is a different operating scenario than a propellant burn. The distribution of emissions from them are also different due to different forces in the burn, such as temperature, force, *etc.* Both types of burns were assessed in the risk assessment at the maximum impact locations associated with each type of burn's distribution. Therefore, the differences in distribution are accounted for in the risk assessment results.

DEQ Response 1-1: This response seems to indicate that there will be no deviation from the proposed burn distribution outlined in the risk assessment. If RAAP is comfortable with permit conditions being implemented based on the assumptions used in the RAR no changes will be required. Otherwise, RAAP should outline the uncertainties associated with these assumptions and the potential impact of deviations from them on risk.

Radford Response 2-1 (Received January 30, 2020): It was clear in prior communication from DEQ that any burn restrictions incorporated into the air modeling or risk assessment would be enforced as restrictions in the Permit. Therefore, we made sure, prior to submittal that we were comfortable with any anticipated permit conditions that may be implemented based on the risk assessment report. To clarify, the following burn restrictions were proposed in the risk assessment report:

- Weather condition limitations, consistent with those contained in our existing permit and incorporated into the air modeling assumptions.
- Propellant burn — Maximum size of 5,600 pounds (to mitigate acute risk) no more than 183 days per year (to mitigate risk from the farmer scenario). No other operating restrictions were necessary based on the risk calculations.
- Skid burn — Maximum size of 2,000 pounds (based on air modeling conditions) any day throughout the year, based on the air modeling assumptions employed. No operating restrictions were necessary based on the risk calculations.

DEQ Response 2-1: DEQ concurs with the reasoning RAAP has provided and the comment is now satisfied.

16. **Section 7.2:** The risk assessment and associated deposition and media concentration calculations appear to have utilized chemical properties data provided in the HHRAP guidance. However, since the guidance was published EPA has revised the chemical properties of some constituents and published those revisions within the RSL tables. These revisions were generally minor and not expected to significantly alter the results of these calculations, but the uncertainties associated with using the values provided in the HHRAP should be noted in this section.

Radford Response 1-1 (Received October 25, 2019): RAAP used the most up-to-date chemical properties for each COPCs as were available in the EPA RSL tables when the assessment was conducted in the 1st quarter of 2019.

DEQ Response 1-1: A spot check of toxicity values used in the risk assessment found that the data used for Tetrachloroethylene, chlorobenzene, and vinyl chloride did not match those found in the latest EPA RSL Table. This was communicated to RAAP when they asked for further clarification.

Radford Response 2-1 (Received January 30, 2020): In response to DEQ's comment, we reviewed the source of the data for the constituents cited above. We offer the following in that regard:

- Tetrachloroethylene — The majority of the data utilized for tetrachloroethylene was taken from the USEPA RSL table as of March 2019, when the risk assessment calculations were conducted. The exceptions to this are:
 - Molecular weight, Kds, ksg, RCF, Brag, Brforage, Bvag, Bvforage, Bamilk, Babeef, Bapork, Baegg, Bachicken, and BCFfish, which was taken from the HHRAP Companion Database

- Kdsw, Kdbs, which was calculated as directed in the HHRAP
- AIEC, which was taken from PACS-1 and represents the AEGL-1
- Chlorobenzene was not a constituent of potential concern in the risk assessment.
- Vinyl chloride was not a constituent of potential concern in the risk assessment.

We note that the current version of the RSL tables shown on EPA's website are dated November 2019. If DEQ made the comparison of our values to the RSL tables on or around the time their letter was drafted, this may be part of the reason for the discrepancy. As noted, the values we pulled from the RSL tables were as of the time the risk assessment time was conducted (March 2019). Our responses to NODs during the risk assessment protocol development clearly indicated that we would use the values that existed at the time the calculations were initiated, which was done.

DEQ Response 2-1: Discussion of this comment will be resolved through the separate comment chain regarding the HHRA Tables that were submitted on December 27, 2019.

DEQ Response 3-1: Comment was resolved and DEQ tentative approval was granted in a letter for the HHRA Tables was sent on June 4, 2020

17. **Section 7.2.3:** Two examples of the limitations of the OBODM software are provided (inability to model wet deposition rates and particle phase emissions in complex terrain). Are there other limitations specific to the OBODM software that could drive uncertainty?

Radford Response 1-1 (Received October 25, 2019): As described in response to DEQ Comment 11, RAAP provided a detailed sensitivity analysis as part of the air modeling effort and ultimate approval to use OBODM in the risk assessment. A reference to this sensitivity analysis was added to Table 7-1 and this section for those wishing to further understand potential uncertainties introduced by OBODM.

DEQ Response 1-1: Please see the response to Comment 11.

Radford Response 2-1 (Received January 30, 2020): We have added additional language to Section 7.2.4 of the risk assessment report to address this comment.

DEQ Response 2-1: DEQ has reviewed the revised text in Section 7.2.4 and the comment is now satisfied.

18. **Section 7.2.6:** A lack of EPA toxicity data does not mean that a compound is not likely to contribute to risks. There are many factors that determine whether a compound is evaluated for toxicity by EPA including frequency of use and availability of resources. Please remove the text suggesting that if toxicity information is unavailable that risks from these compounds should be considered minimal.

Mr. Jody Hawks
Environmental Manager
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July 24, 2020

Radford Response 1-1 (Received October 25, 2019): We have modified the discussion in the referenced section.

DEQ Response 1-1: DEQ concurs with RAAP's response and the comment is now satisfied.

Radford Response 2-1 (Received January 30, 2020): Based on DEQ's comment above, no further action is required in response to this NOD.

DEQ Response 2-1: Comment satisfied.